Rapid Acceleration of the Wyrtki Jet in the Central Indian Ocean by a Cyclone-Assisted Wind Burst Embedded Within an MJO Event

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Zonal currents at the Equator

0, 140W (central Pacific Ocean)

Trade Winds

- SEC
- EUC

meridional divergence at surface

similar structure in Atlantic

0, 80E (central Indian Ocean)

Westerlies

- Wyrtki Jet
- EUC

meridional convergence at surface

structure is unsteady surface current relaxes and even reverses with surface winds
arrival of leading front of cyclone-assisted MJO
**1D mixed layer heat budget**

\[
\frac{dH_h}{dt} = J^0_q - I_h - J^h_q
\]

mixed layer heating rate =

- surface heat flux –
- penetrating radiation -
- turbulent heat flux through mixed layer base

all terms measured

1D balance exists when

red diamonds = blue line

Relative roles of individual terms change with mixed layer depth and intensity of surface forcing
Cross-equatorial structure of the Wyrtki Jet before and after passage of the cyclone-assisted MJO wind burst.
1st order u-momentum:
\[ h \rho \frac{\partial u}{\partial t} \, dz = \tau_x^0 - \tau_x^h \]
Summary

• measurements at 0, 80.5E in October/November 2011 include passage of a major MJO event

• although accompanied by considerable precipitation, the ocean surface quickly became saltier as subsurface entrainment mixing up salty water from below

• during the event, mixed layer cooling is completely balanced one-dimensionally
  • cooling rate of 0.4 k/day is due to -320 W m\(^{-2}\) from above to the atmosphere and -180 W m\(^{-2}\) from below due to subsurface mixing

• to first order, the acceleration of the Wyrtki Jet from 12 Sv (+/- 1 degree from the equator) to 24 Sv, quadrupling system kinetic energy, is balanced simply by the wind stress at the sea surface.